

N(2220) 9/2⁺ $I(J^P) = \frac{1}{2}(\frac{9}{2}^+)$ Status: ***

Most of the results published before 1975 were last included in our 1982 edition, Physics Letters **111B** 1 (1982). Some further obsolete results published before 1980 were last included in our 2006 edition, Journal of Physics, G **33** 1 (2006).

N(2220) BREIT-WIGNER MASS

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2200 to 2300 (\approx 2250) OUR ESTIMATE			
2316.3 \pm 2.9	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
2230 \pm 80	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
2205 \pm 10	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
2300 \pm 100	HENDRY	78	MPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2270 \pm 11	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
2258	ARNDT	95	DPWA $\pi N \rightarrow N\pi$

NODE=B090

N(2220) BREIT-WIGNER WIDTH

VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
350 to 500 (\approx 400) OUR ESTIMATE			
633 \pm 17	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
500 \pm 150	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
365 \pm 30	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
450 \pm 150	HENDRY	78	MPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
366 \pm 42	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
334	ARNDT	95	DPWA $\pi N \rightarrow N\pi$

NODE=B090W

N(2220) POLE POSITION

REAL PART VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
2130 to 2200 (\approx 2170) OUR ESTIMATE			
2150 \pm 35	ANISOVICH	12A	DPWA Multichannel
2199	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
2135	¹ HOEHLER	93	ARGD $\pi N \rightarrow \pi N$
2160 \pm 80	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
2209	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
2203	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
2253	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90

NODE=B090215

-2xIMAGINARY PART VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
400 to 560 (\approx 480) OUR ESTIMATE			
440 \pm 40	ANISOVICH	12A	DPWA Multichannel
372	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
400	² HOEHLER	93	ARGD $\pi N \rightarrow \pi N$
480 \pm 100	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
564	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
536	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
640	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90

NODE=B090IM

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→ UNCHECKED ←

N(2220) ELASTIC POLE RESIDUE

MODULUS <i>r</i> VALUE (MeV)	DOCUMENT ID	TECN	COMMENT
60 \pm 12	ANISOVICH	12A	DPWA Multichannel
33	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
40	HOEHLER	93	ARGD $\pi N \rightarrow \pi N$
45 \pm 20	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$

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NODE=B090RER

NODE=B090RER

• • • We do not use the following data for averages, fits, limits, etc. • • •

96	ARNDT	04	DPWA	$\pi N \rightarrow \pi N, \eta N$
68	ARNDT	95	DPWA	$\pi N \rightarrow N\pi$
85	ARNDT	91	DPWA	$\pi N \rightarrow \pi N$ Soln SM90

PHASE θ

VALUE (°)

	DOCUMENT ID	TECN	COMMENT
-58 ± 12	ANISOVICH	12A	DPWA Multichannel
-33	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
-50	HOEHLER	93	ARGD $\pi N \rightarrow \pi N$
-45 ± 25	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
-71	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
-43	ARNDT	95	DPWA $\pi N \rightarrow N\pi$
-62	ARNDT	91	DPWA $\pi N \rightarrow \pi N$ Soln SM90

NODE=B090IMR
NODE=B090IMR

N(2220) DECAY MODES

The following branching fractions are our estimates, not fits or averages.

Mode	Fraction (Γ_i/Γ)
$\Gamma_1 N\pi$	15–25 %
$\Gamma_2 N\eta$	
$\Gamma_3 \Lambda K$	

N(2220) BRANCHING RATIOS

$\Gamma(N\pi)/\Gamma_{\text{total}}$

VALUE (%)

15 to 25 OUR ESTIMATE

	DOCUMENT ID	TECN	COMMENT
24 ± 5	ANISOVICH	12A	DPWA Multichannel
24.6 ± 0.1	ARNDT	06	DPWA $\pi N \rightarrow \pi N, \eta N$
15 ± 3	CUTKOSKY	80	IPWA $\pi N \rightarrow \pi N$
18.0 ± 1.5	HOEHLER	79	IPWA $\pi N \rightarrow \pi N$
12 ± 4	HENDRY	78	MPWA $\pi N \rightarrow \pi N$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
20.0 ± 0.6	ARNDT	04	DPWA $\pi N \rightarrow \pi N, \eta N$
26	ARNDT	95	DPWA $\pi N \rightarrow N\pi$

Γ_1/Γ

$(\Gamma_1\Gamma_f)^{1/2}/\Gamma_{\text{total}}$ in $N\pi \rightarrow N(2220) \rightarrow \Lambda K$

VALUE

DOCUMENT ID	TECN	COMMENT
BELL	83	DPWA $\pi^- p \rightarrow \Lambda K^0$
SAXON	80	DPWA $\pi^- p \rightarrow \Lambda K^0$

$(\Gamma_1\Gamma_3)^{1/2}/\Gamma$

N(2220) PHOTON DECAY AMPLITUDES

Papers on γN amplitudes predating 1981 may be found in our 2006 edition, Journal of Physics, G **33** 1 (2006).

$N(2220) \rightarrow p\gamma$, helicity-1/2 amplitude $A_{1/2}$

VALUE (GeV^{-1/2})

DOCUMENT ID	TECN	COMMENT
<0.01	3 ANISOVICH	12A DPWA Multichannel

NODE=B090R3
NODE=B090R3

$N(2220) \rightarrow p\gamma$, helicity-3/2 amplitude $A_{3/2}$

VALUE (GeV^{-1/2})

DOCUMENT ID	TECN	COMMENT
<0.01	3 ANISOVICH	12A DPWA Multichannel

NODE=B090240

NODE=B090240

NODE=B090A1
NODE=B090A1

NODE=B090A2
NODE=B090A2

NODE=B090

NODE=B010;LINKAGE=H9

NODE=B090;LINKAGE=H9

NODE=B090A1;LINKAGE=AN

¹ See HOEHLER 93 for a detailed discussion of the evidence for and the pole parameters of N and Δ resonances as determined from Argand diagrams of πN elastic partial-wave amplitudes and from plots of the speeds with which the amplitudes traverse the diagrams.

² See HOEHLER 93 for a detailed discussion of the evidence for and the pole parameters of N and Δ resonances as determined from Argand diagrams of πN elastic partial-wave amplitudes and from plots of the speeds with which the amplitudes traverse the diagrams.

³ This ANISOVICH 12A value is the complex helicity amplitude at the pole position.

N(2220) REFERENCES

For early references, see Physics Letters **111B** 1 (1982).

ANISOVICH	12A	EPJ A48 15	A.V. Anisovich <i>et al.</i>	(BONN, PNPI)	REFID=54041
ARNDT	06	PR C74 045205	R.A. Arndt <i>et al.</i>	(GWU)	REFID=51535
PDG	06	JPG 33 1	W.-M. Yao <i>et al.</i>	(PDG Collab.)	REFID=51004
ARNDT	04	PR C69 035213	R.A. Arndt <i>et al.</i>	(GWU, TRIU)	REFID=49947
ARNDT	95	PR C52 2120	R.A. Arndt <i>et al.</i>	(VPI, BRCO)	REFID=44535
HOEHLER	93	πN Newsletter 9 1	G. Hohler	(KARL)	REFID=43821
ARNDT	91	PR D43 2131	R.A. Arndt <i>et al.</i>	(VPI, TELE) IJP	REFID=41467
BELL	83	NP B222 389	K.W. Bell <i>et al.</i>	(RL) IJP	REFID=30409
PDG	82	PL 111B 1	M. Roos <i>et al.</i>	(HELS, CIT, CERN)	REFID=41167
CUTKOSKY	80	Toronto Conf. 19	R.E. Cutkosky <i>et al.</i>	(CMU, LBL) IJP	REFID=30064
Also		PR D20 2839	R.E. Cutkosky <i>et al.</i>	(CMU, LBL) IJP	REFID=40096
SAXON	80	NP B162 522	D.H. Saxon <i>et al.</i>	(RHEL, BRIS) IJP	REFID=30404
HOEHLER	79	PDAT 12-1	G. Hohler <i>et al.</i>	(KARLT) IJP	REFID=30058
Also		Toronto Conf. 3	R. Koch	(KARLT) IJP	REFID=30859
HENDRY	78	PRL 41 222	A.W. Hendry	(IND, LBL) IJP	REFID=30893
Also		ANP 136 1	A.W. Hendry	(IND)	REFID=30901